ND T 304 – UNCOMPACTED VOID CONTENT OF FINE AGGREGATE

Conduct this procedure according to ND T 304, Method A

The AASHTO standard test procedure specifies the uncompacted voids be reported to the nearest 0.1%. The NDDOT modification specifies the uncompacted voids be reported to the nearest whole number.

Consult the current edition of AASHTO for procedure in its entirety and equipment specification details.

SCOPE

Method A determines the loose uncompacted void content of a sample of fine aggregate. When measured on any aggregate of a known grading, uncompacted void content provides an indication of the aggregate's angularity, spherical shape, and surface texture compared to other fine aggregates tested in the same grading. This test is also referred to as the "Fine Aggregate Angularity Test."

REFERENCED DOCUMENTS

ND T 2 and AASHTO T 2, Sampling of Aggregates
ND T 11 and AASHTO T 11, Materials Finer than No. 200 Sieve in Mineral Aggregates by Washing
AASHTO T 19, Bulk Density (Unit Weight) and Voids in Aggregate
ND T 27 and AASHTO T 27, Sieve Analysis of Fine and Coarse Aggregate
ND T 84 and AASHTO T 84, Specific Gravity and Absorption of Fine Aggregate
ND T 248 and AASHTO T 248, Reducing Samples of Aggregate to Testing Size
ND T 255 and AASHTO T 255, Total Evaporable Moisture Content of Aggregate by Drying
AASHTO T 304, Uncompacted Void Content of Fine Aggregate

APPARATUS

Balance, accurate to 0.1 g
100 mL Cylinder
200 mL Funnel
Funnel stand, 3 or 4 legged
Glass plate, 60 x 60 mm by 4 mm thick
Grease
Pan, large enough to contain cylinder and funnel stand
Metal spatula with straight edge
Pans

TEST SPECIMEN

Obtain a sample of aggregate according to ND T 2. Thoroughly mix and reduce according to ND T 248. Test specimen shall be a representative sample of approximately 1000 g of fine aggregate.

Wash the sample over a No. 100 or No. 200 sieve according to ND T 11. Dry the sample according to ND T 255. Perform a gradation according to ND T 27.

Remove the individual fractions as defined by table below. Place the material from each fraction into separate containers.

A 190-g sample is needed and portions retained from each individual sieve are combined in the following amounts:

Individual Size Fraction	Weight
No. 8 to No. 16	44 g
No. 16 to No. 30	57 g
No. 30 to No. 50	72 g
No. 50 to No. 100	17 g

PROCEDURE

All information is recorded on SFN 51701. The cylinder calibration procedure is included at the end of this procedure.

Weights are recorded to the nearest 0.1 g.

Thoroughly mix the 190-g sample with the spatula.

Weigh the empty cylinder and record as weight of cylinder.

Set up the funnel apparatus with a pan underneath to catch any loose aggregate. Place the empty cylinder under the funnel. Funnel must be 115 ± 2 mm (4.53 ± 0.08") above the top of the cylinder.

Hold your finger over the bottom of the funnel and pour the sample into the top. Level the material in the funnel with the metal spatula. Release your finger allowing the sample to flow into the cylinder.

Strike off the top of the cylinder by a rapid single pass with a straightedge. The blade of the spatula must be vertical, keeping the edge horizontal and in light contact with the top of the measure. Brush away any loose material from the

outside and weigh the cylinder plus aggregate. Weigh and record as weight of cylinder plus aggregate.

Retain and recombine all material for the second trial. Repeat the procedure.

CALCULATIONS

The percent of uncompacted voids content of fine aggregate is calculated as follows:

Uncompacted Voids in Percent = [(V – (F/G)]/V x 100

V = Volume of calibrated cylinder in mL
F = Net weight of sample in cylinder, gross weight mass of empty cylinder
G = Bulk specific gravity, dry, as determined by ND T 84

Average the results of the two trials.

REPORT

Report the percentage of uncompacted voids to the nearest whole percent.

NOTES

After strike-off, the cylinder may be tapped lightly to compact the sample to make it easier to transfer the container to the balance without spilling any of the sample.

If the specific gravity of fine aggregate is not known, determine by ND T 84.

CALIBRATION

A calibration check of the equipment should be performed annually as a minimum, or whenever damage or repair occurs.

CYLINDER CALIBRATION

Calibrate the cylinder according to ND T 304. Record the information on SFN 51729. Record the weights to the nearest 0.1 g. Use AASHTO T 19 as a reference to determine the density of the water.

Apply a light coat of grease to the top edge of the dry, empty cylinder. Weigh the cylinder, grease, and glass strike-off plate. Record the weight.

Fill the cylinder with freshly boiled, deionized water cooled to a temperature of 64° to 75°F (18° to 24°C). Record the temperature of the water.

Slide the glass plate on the measure making sure no air bubbles remain. Dry the outside of the cylinder and weigh, including the strike-off plate. Record the weight.

The volume of the cylinder is calculated as follows:

$$V = 1000 \times (M/D)$$

V = Volume of cylinder, mL
M = Net mass of water, g
D = Density of water

Density of water is determined by using AASHTO T 19. The following table can be used to determine the density of water.

Density of Water		
°F	°C	kg/m^3
60	15.6	999.01
65	18.3	998.54
70	21.1	997.97
73.4	23.0	997.54
75	23.9	997.32
80	26.7	996.59

Calculate volume to nearest 0.1 mL.

If the volume is greater than 100.0 mL, the upper edge may be ground until the volume is exactly 100.0 mL.